

CHANGING PATTERNS IN WORLD NITROGEN
FERTILIZER PRODUCTION AND TRADE

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Changing Patterns in World Nitrogen Fertilizer Production and Trade

By Carol K. Briggs and I. Y. Borg

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Summary

Nitrogen fertilizer production and exports are shifting from the United States, Western Europe and Japan to countries that have the largest and cheapest reserves of natural gas, the most widely used feedstock for ammonia production. This report documents this shift using 10-year historical plots of production and consumption of nitrogenous fertilizers in developed, Communist and less developed countries (which include OPEC).

While world production and consumption of nitrogenous fertilizers has been increasing at a rate of 6.5%/year over the past decade, the contribution of developed countries to the production as a percent of the total has been steadily declining. At the same time the Communist and LDC's contribution as a percent of the total has increased. As a consequence the U.S. has become a net importer of nitrogenous fertilizer. Exports from USSR and some Comecon countries along with OPEC have increased. Projected expansion of ammonia capacity (hence of fertilizer production) in these same countries suggest that these trends will continue.

The reason for these changes lies in the changing availability and pricing of natural gas in the U.S. and other developed countries.

1. Shift in Nitrogen Fertilizer Capacity and Production

Nitrogen fertilizer production and positive trade are shifting from the United States, Western Europe and Japan to those countries that have the largest and cheapest reserves of natural gas. TVA's Richard M. Freeman indicates that from 1980 to 1985, 17 million metric tons of new fertilizer capacity is scheduled to come on stream. Approximately 40% of this new capacity will come from Middle Eastern and Asian countries which have abundant supplies of natural gas, and 32% will come from the USSR which ranks second in the world in total gas supplies.¹

World production of nitrogen fertilizer has increased from 28.2 million metric tons in fertilizer year 1968/9 to 48.8 million metric tons 1977/8 (Fig. 1)*. (The 1980 FAO Yearbook will provide 1978/9 data based on figures available at the end of April 1980). Figure 2 shows contributions to world production and consumption of nitrogenous fertilizers in total metric tons of nitrogen. It is apparent that for at least 10 years production in Communist and less developed countries (which include OPEC countries) has been increasing more rapidly than in developed countries. Figure 3 shows this data as a percent of the total.

Over the period from 1975/6 to 1981/2 actual and projected production capacity of ammonia has increased most dramatically in the Soviet Union, China, OPEC countries, India and Mexico (Fig. 4). Smaller increases in capacity took place from 1977/8 to 1978/9 in Western Europe, United States and Japan with no new capacity planned for the latter two after 1978/9.

* World production normally exceeds world consumption by about 5% reflecting (1) overformulation in compound fertilizers, (2) distribution losses including pilferage, (3) inherent problems of measuring and reporting fertilizer usage, and (4) material in the distribution pipeline.

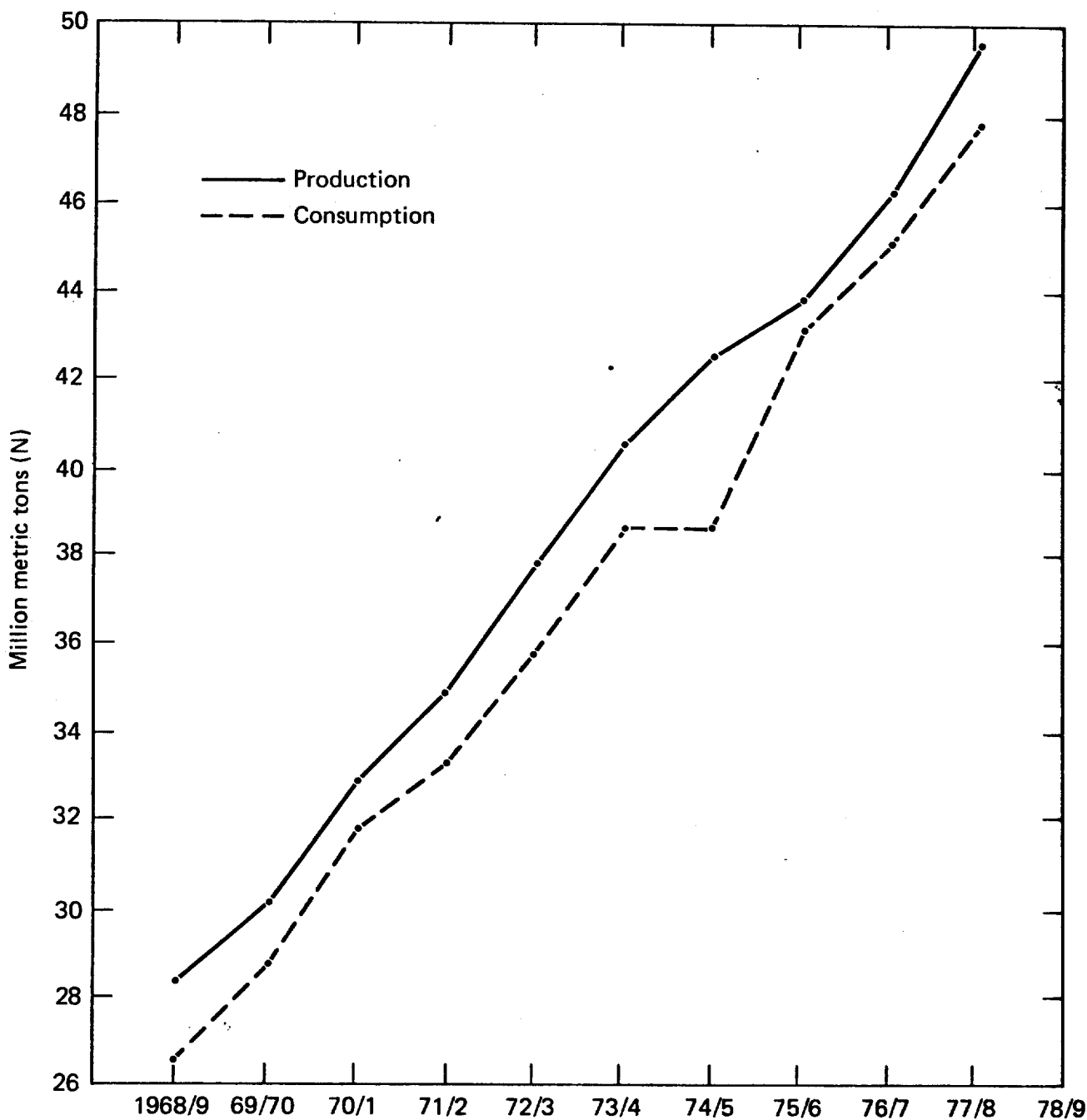


Figure 1. World Production and Consumption of Nitrogen Fertilizers, 1968/9-1977/8.

Source: 1968/9-1973/4, 1974 Annual Fertilizer Review, Food and Agriculture Organization of the United Nations, Table 1.
1974/5 - 1977/8, 1978 Annual Fertilizer Review, FAO, Table 1.

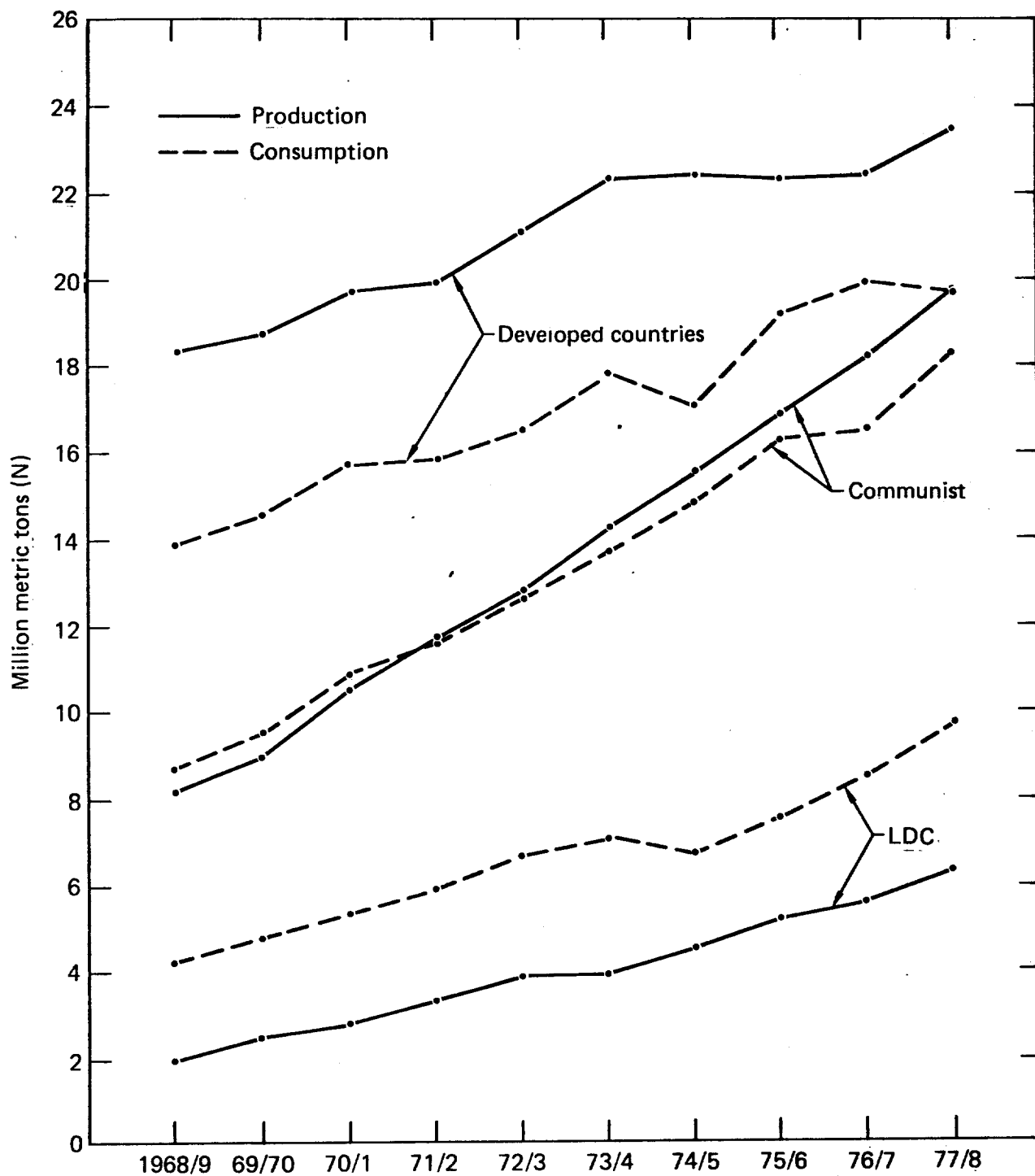


Figure 2. Contributions to World Production and Consumption of Nitrogenous Fertilizers.

Source: 1968/9-1973/4, 1974 Annual Fertilizer Review, FAO, Table 2
 1974/5-1977/8, 1978 Annual Fertilizer Review, FAO, Table 2

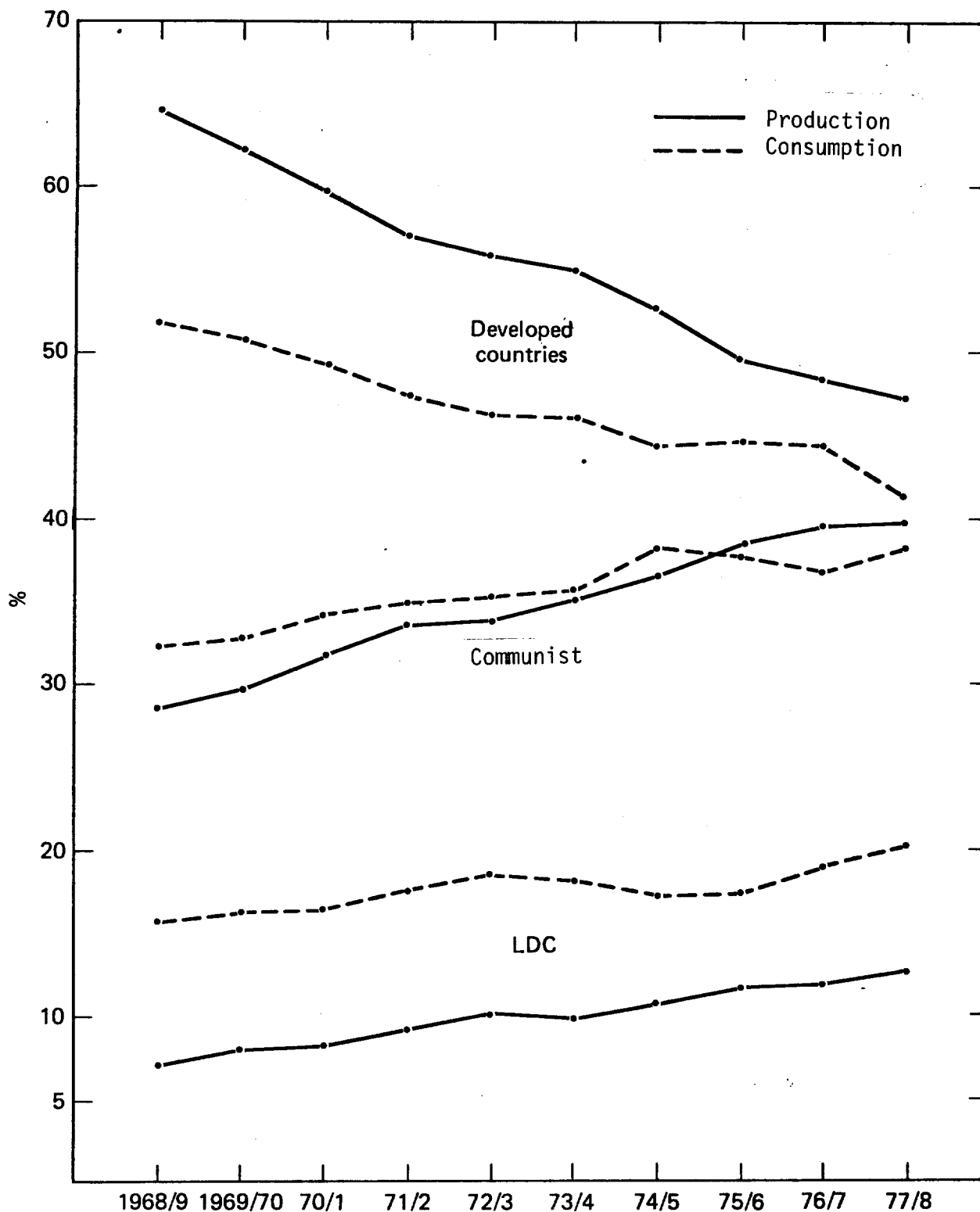


Figure 3. Contributions to World Production and Consumption of Nitrogen in Fertilizer as Percent of Total

Source: 1968/9-1973/4, 1974 Annual Fertilizer Review, FAO, Table 5,6
1974/5-1977/8, 1978 Annual Fertilizer Review, FAO, Table 5

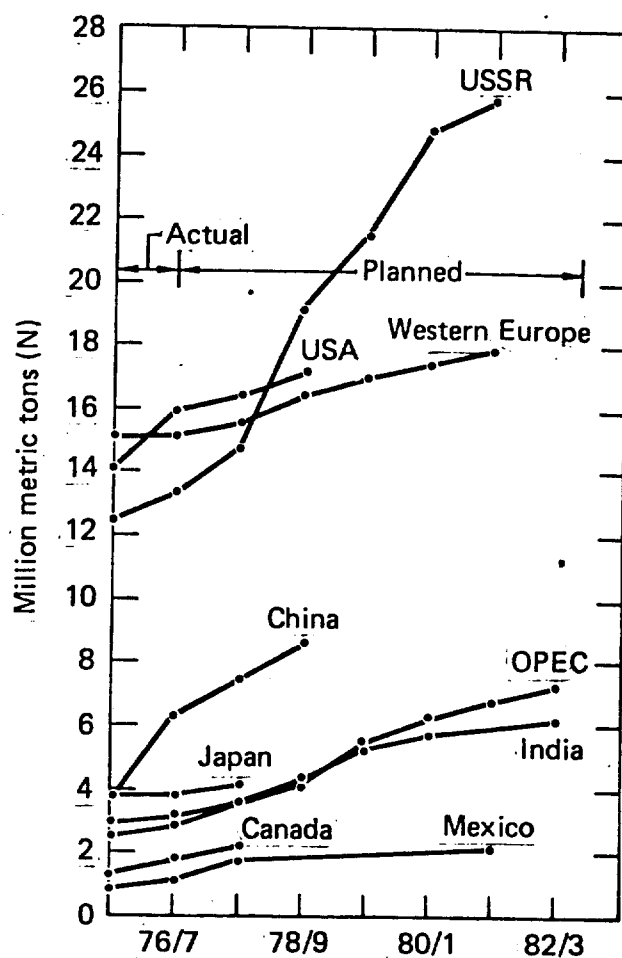


Figure 4. Announced Plans for Increased Production Capacity of Ammonia

Source: 1975/6, Actual Capacity, 1976 Annual Fertilizer Review, Table 16
 1976/7, Actual Capacity, 1977 Annual Fertilizer Review, Table 16
 1977/8-1982/3, Based on Planned New Capacity, 1978 Annual Fertilizer Review, Table 15.

II. Increased capacity could lead to glut, but instead a world shortage appears likely.

Despite increasing world supplies for the past decade, ammonia is today in short supply, and prices have risen from \$80/metric ton (1979) to a current range of \$120-150.² TVA economists John Douglas and Edwin Harre cite rapid increases in world prices of naphtha, fuel oil and natural gas, all feedstocks for ammonia production, as contributors to the ammonia shortage.³

An interesting comparison of estimated urea production costs in the U.S., Japan and Indonesia is given in Table 1.

Table 1 Estimated Urea Production Costs

		U.S.	Japan	Indonesia
1970 Feedstock	Natural gas (US\$/million BTU)	0.20	--	0.20
price	Naphtha (US\$/ton)	--	22.09	----
Urea production costs		48	35	36
1977 Feedstock	Natural gas (US\$/million BTU)	1.38	---	0.60
price	Naphtha (US\$/ton)	---	147.90	---
Urea production costs		106	121	72
1982 Feedstock	Natural gas (US\$/million BTU)	3.19	----	0.85
price	Naphtha (US\$/ton)	--	209.25	--
Urea production costs		158	159	104

Source:

Tetsuo Inooka, "International Supply - Demand Balance of Nitrogen Fertilizers," Chemical Economy and Engineering Review, May 1979, p.8.

Several other feedstock and raw material supply situations have contributed to the shortage. Bad weather caused operating and construction problems for USSR's expansion program of 40 or more large scale ammonia plants which were to have started operations between 1978 and 1982. Support to these new units was inadequate, and delivery of natural gas was far short of expectation. This affected ammonia capacity in related Eastern European countries as well. Also the Iranian crisis has shut off Iranian gas to the USSR. It comprises about 2% of the Soviet gas supply, but it is a key source for ammonia plants in the Caucasus. This shut down plants in USSR and later curtailed production of 1.3 million metric tons of nitrogen for at least nine months.² Mexico is another country having problems operating new ammonia capacity brought into operation in the past two years.

Plant closures and depressed operating rates will be forthcoming in Western Europe and Japan which are totally dependent on imported feedstocks. By the end of 1978 Japan had closed down 1.5 million metric tons per year of nitrogen fertilizer capacity and announced that an added 26% of its capacity would be closed in the Fall of 1979.³ Indonesia, leading fertilizer producer in its region, was expected to fill the void of Japan's closures. However, it currently does not have enough gas to run all its new units at full capacity.

Harris and Harre report that the U.S. demand for nitrogen fertilizer in 1978 consumed all that was both produced and imported as well as 0.5 - 1.0 million metric tons from inventory. The U.S. has no new scheduled ammonia capacity and of its 24.4 million metric tons of total rated production capacity, over 4 million metric tons are shut down as a result of cost - price squeezes.

The recent embargo on 17 million metric tons of grain to the USSR, prompted by the Russian invasion of Afghanistan, has caused a drop in corn and wheat prices. Nonetheless there has been a 14% increase in domestic sales of fertilizer materials for the first six months of the 1979-80 fertilizer year (beginning July 1) compared to the corresponding 1978-9 period reducing producers' inventories to record low levels.² Fertilizer Institute President Edwin M. Wheeler predicts that farmers will still continue to use large quantities of fertilizer.

III. Fertilizer Trade Patterns are Changing

The U.S. has become a net importer of anhydrous ammonia (NH_3) and nitrogenous fertilizers (including urea) over the past few years (Figure 5). Any increased demand will be met by increased imports. (Anhydrous ammonia trade is tabulated separately and is not included in the nitrogenous fertilizer net export plot in Figure 5.) President Carter also ordered a one-year quota of one million tons on the import of anhydrous ammonia from Russia (plus an embargo on shipments of phosphates to Russia).⁵ Therefore sufficient ammonia imports to the U.S. are questionable. Furthermore, a shortage of ammonia shipping terminals makes handling ammonia imports difficult.

Urea (46% N) shows increasingly larger market share among nitrogenous fertilizers because its small granular form makes it safer and easier to transport than anhydrous ammonia. In addition its slow, controlled release of nitrogen is desirable for most crops. Current world urea capacity is estimated to be 28 million metric tons of N. It is scheduled to increase to almost 38 million metric tons by 1980 and to 45 million metric tons by 1985. At this growth rate urea will have the greatest share of the world fertilizer market by 1985.⁴ Newsworthy is the new 0.5 million metric tons per year urea plant to be built in Saudi Arabia by Saudi Basic Industries Corp. (SABIC) and Taiwan Fertilizer Co. and anticipated for operation in 1984.⁶

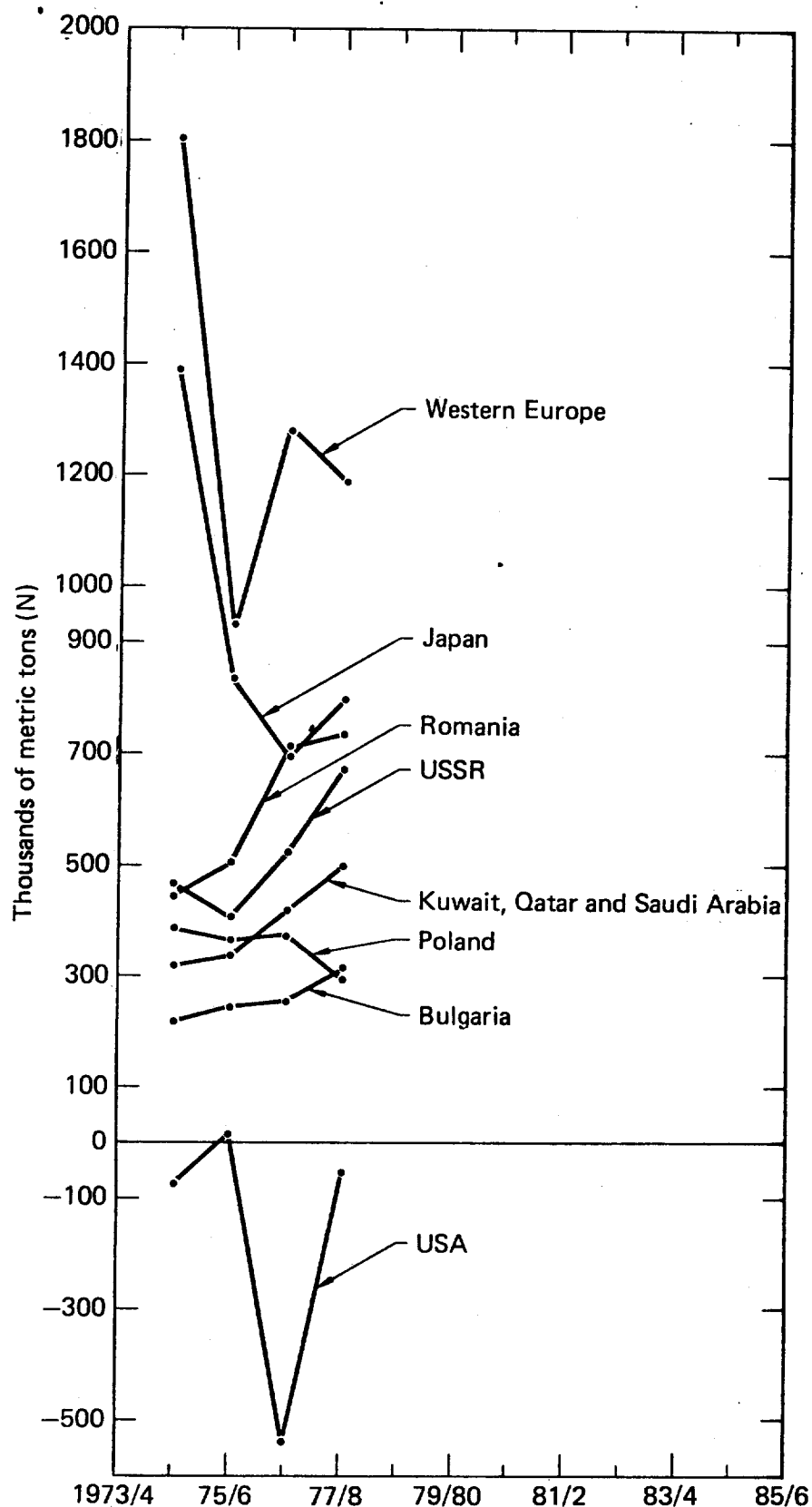


Figure 5. Net Exports of Nitrogenous Fertilizers. Note: These include ammonium nitrate, ammonium sulfate, sodium nitrate, urea, ammonium phosphate, calcium nitrate, calcium cyanamide and other complex fertilizers.

Source: 1978 Annual Fertilizer Review, FAO, Tables II and III.

Is India moving toward self-sufficiency in nitrogen fertilizers? Level of construction for new facilities would indicate it is, or should be; but low-operating rates in existing facilities and the demand for ammonia in non-agricultural uses necessitate continuous import of nitrogen fertilizer.⁷

In China good progress in construction of new plants and a relatively low level of imports indicate strong moves toward self-sufficiency. However, Chinese fertilizer demand increased more rapidly than expected because of the rapid development of China's agricultural modernization plan which includes intensive utilization of farm land.⁸

IV. Conclusion

Because of abundant and relatively cheap natural gas feedstock supplies, nitrogen fertilizer production in the USSR, certain Asia countries and oil producing Middle Eastern countries will probably continue to increase over the next several years as new construction continues and operating and pipeline problems are corrected. However, the outlook for increased or even current production levels in the U.S., Western Europe and Japan is not good as natural gas prices increase and supplies decrease. The U.S. promises to be increasingly dependent on foreign nitrogenous fertilizer supplies in the future.

References

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7. Tetsuo Inooka, Chemical Economy and Engineering Review, May 1979, p. 9,10.
8. Ibid, p. 11.